Hazardous Weather Testbed Activities

Russell S. Schneider & Steven J. Weiss

NWS Storm Prediction Center

Jack Kain, Travis Smith, Mike Coniglio, Greg Stumpf

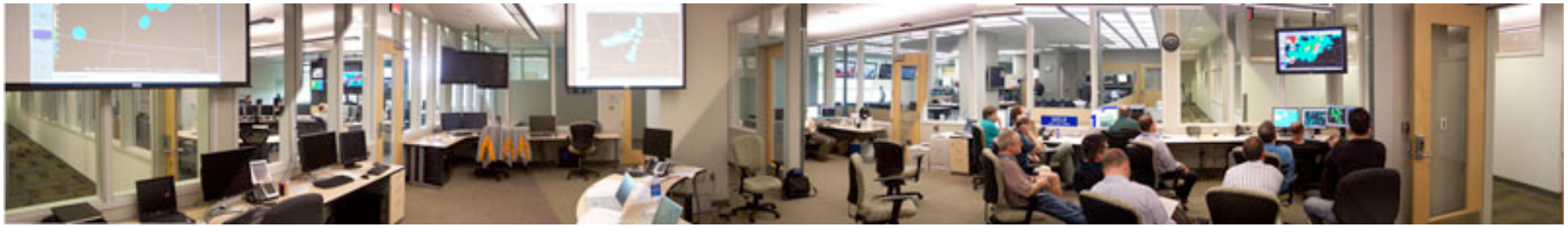
NOAA National Severe Storms Laboratory

Tara Jenson (DTC), Chris Siewert (SPC- GOES-R)

NOAA Testbed Workshop
April 2010

"Where America's Weather and Climate Services Begin"

NOAA Hazardous Weather Testbed



Experimental
Forecast
Program

*Prediction of hazardous weather events from **a few hours to a week in advance***

EFP

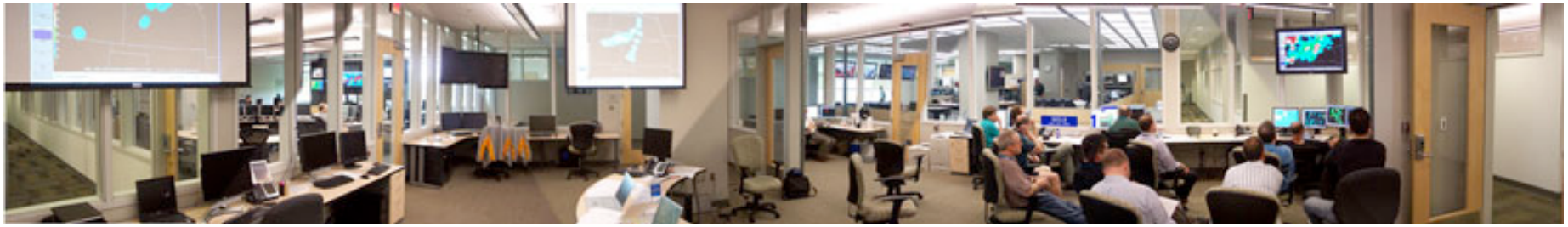
EWP

GOES-R
Proving Ground

Experimental
Warning
Program

*Detection and prediction of hazardous weather events **up to several hours in advance***

NOAA Hazardous Weather Testbed



Experimental
Forecast
Program

*Prediction of hazardous weather events from **a few hours to a week in advance***

EFP

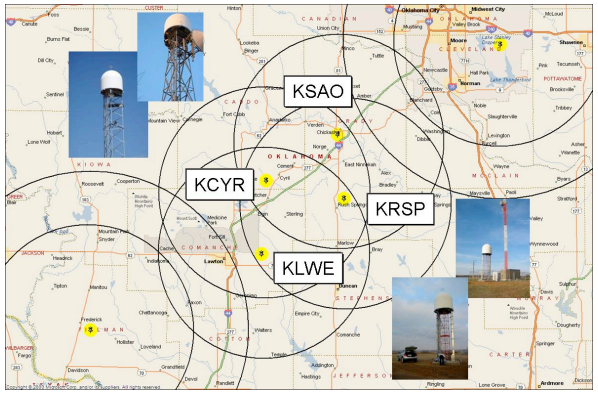
EWP

GOES-R
Proving Ground

Experimental
Warning
Program

*Detection and prediction of hazardous weather events **up to several hours in advance***

EWP Experiments - 2010



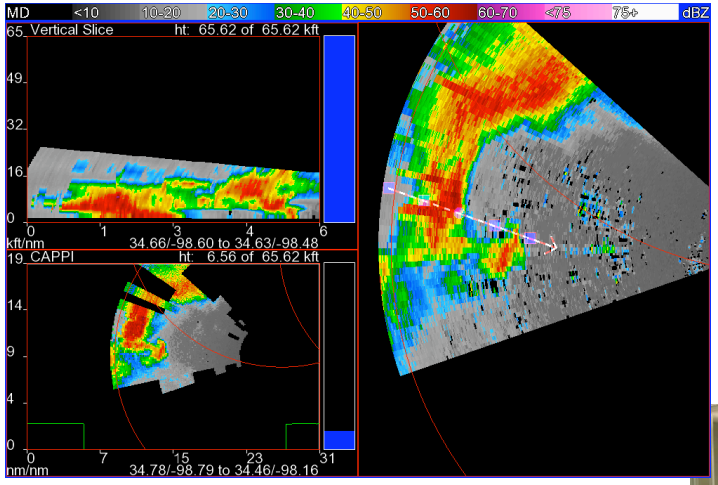
Broad Collaboration
National scope

34 NWS Forecasters (from all NWS regions)

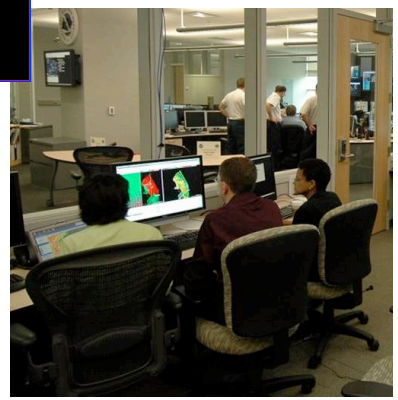
NOAA research

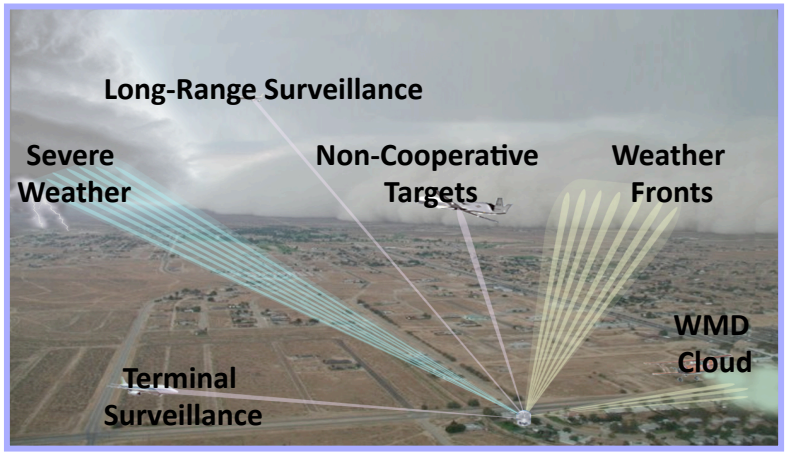
Multiple University Collaborators

PARISE: **Phased Array** Innovative Sensing Experiment

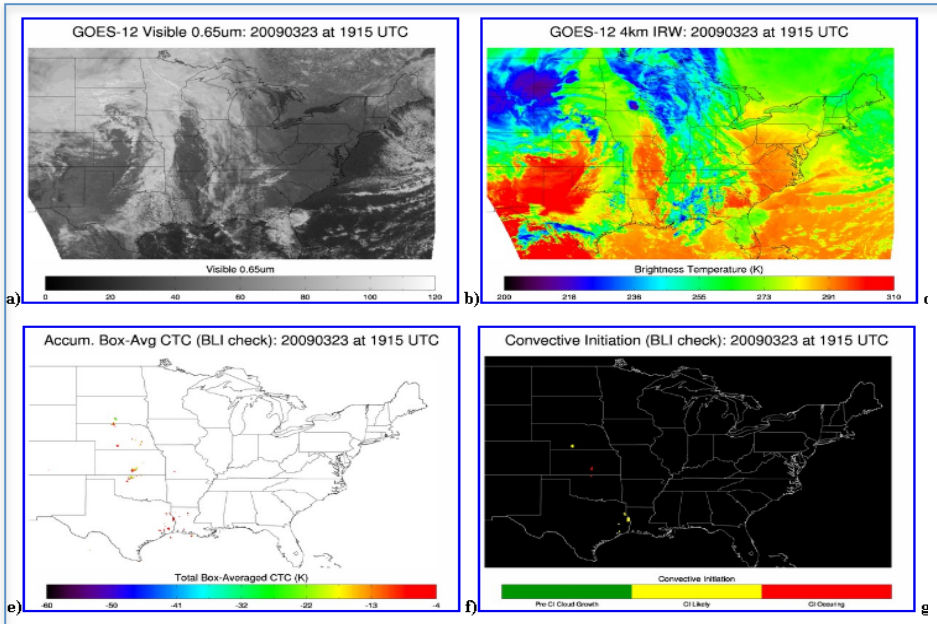


Collaborative Adaptive Sensing of the Atmosphere (**CASA**) Experiment

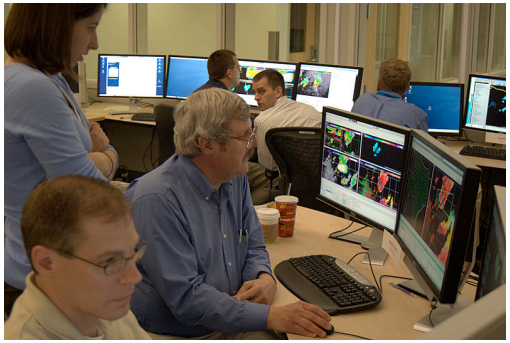




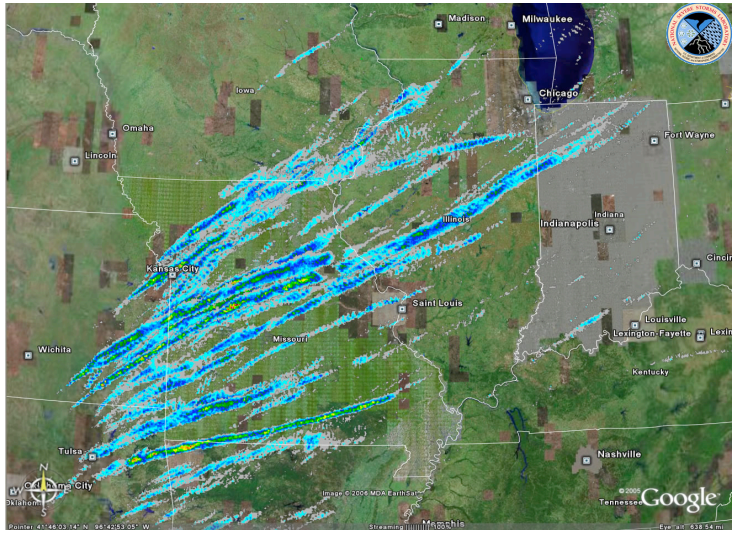
EWP Experiments - 2010



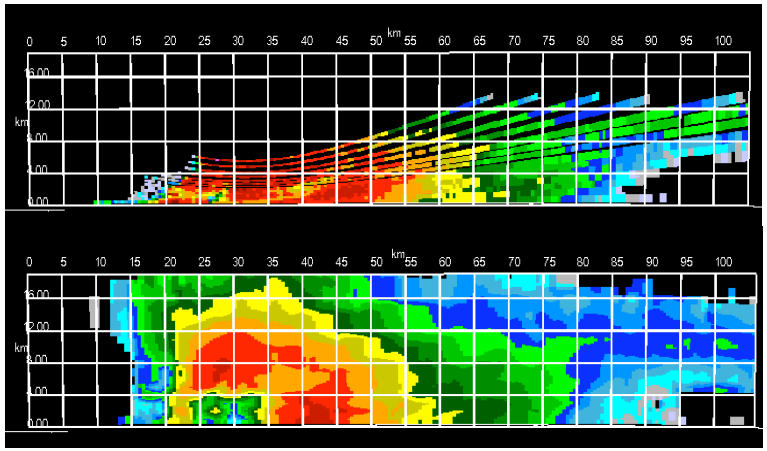
GOES-R products, such as Convective Initiation and Global Lightning Mapping (proxy)



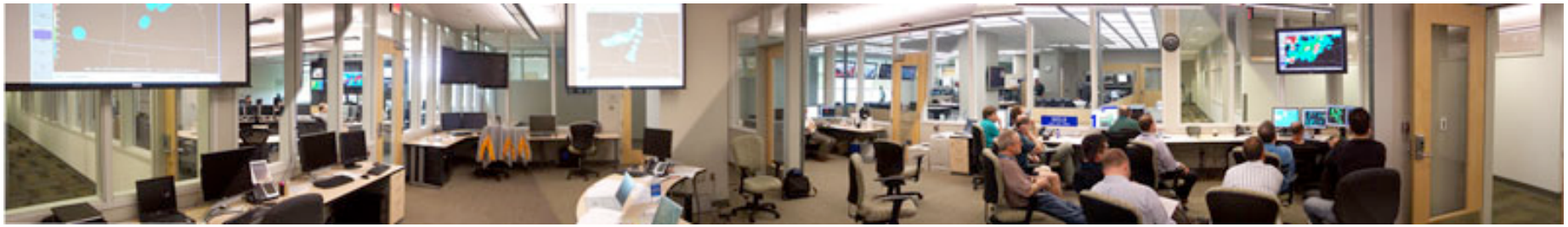
Soon: **Warn-on-Forecast** real-time radar data assimilation



Multi-radar / multi-sensor products, such as 3D CONUS reflectivity, hail size estimates, "rotation tracks"



NOAA Hazardous Weather Testbed



Experimental
Forecast
Program

*Prediction of hazardous weather events from **a few hours to a week in advance***

EFP

EWP

GOES-R
Proving Ground

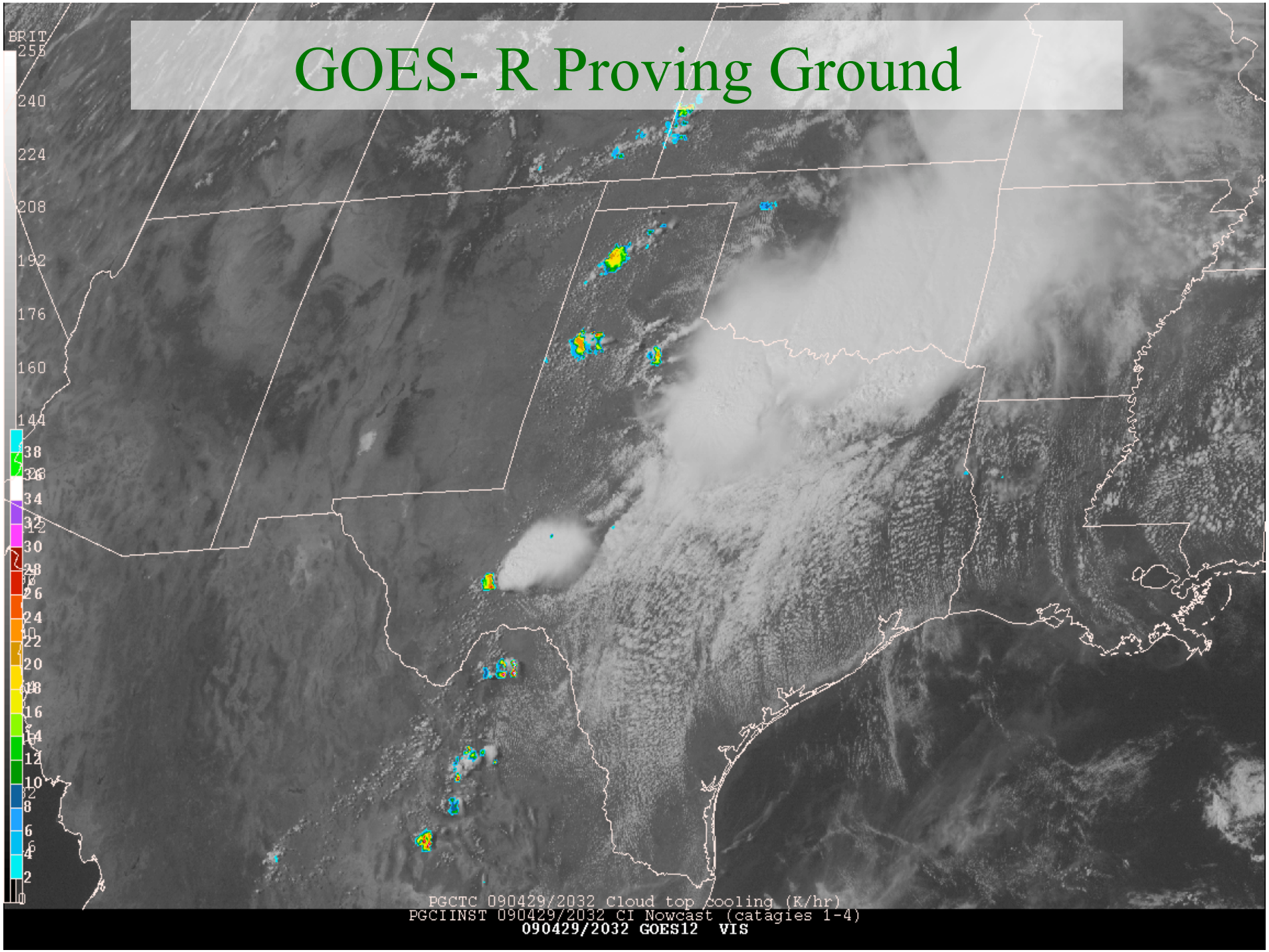
Experimental
Warning
Program

*Detection and prediction of hazardous weather events **up to several hours in advance***

NOAA NWS Storm Prediction Center

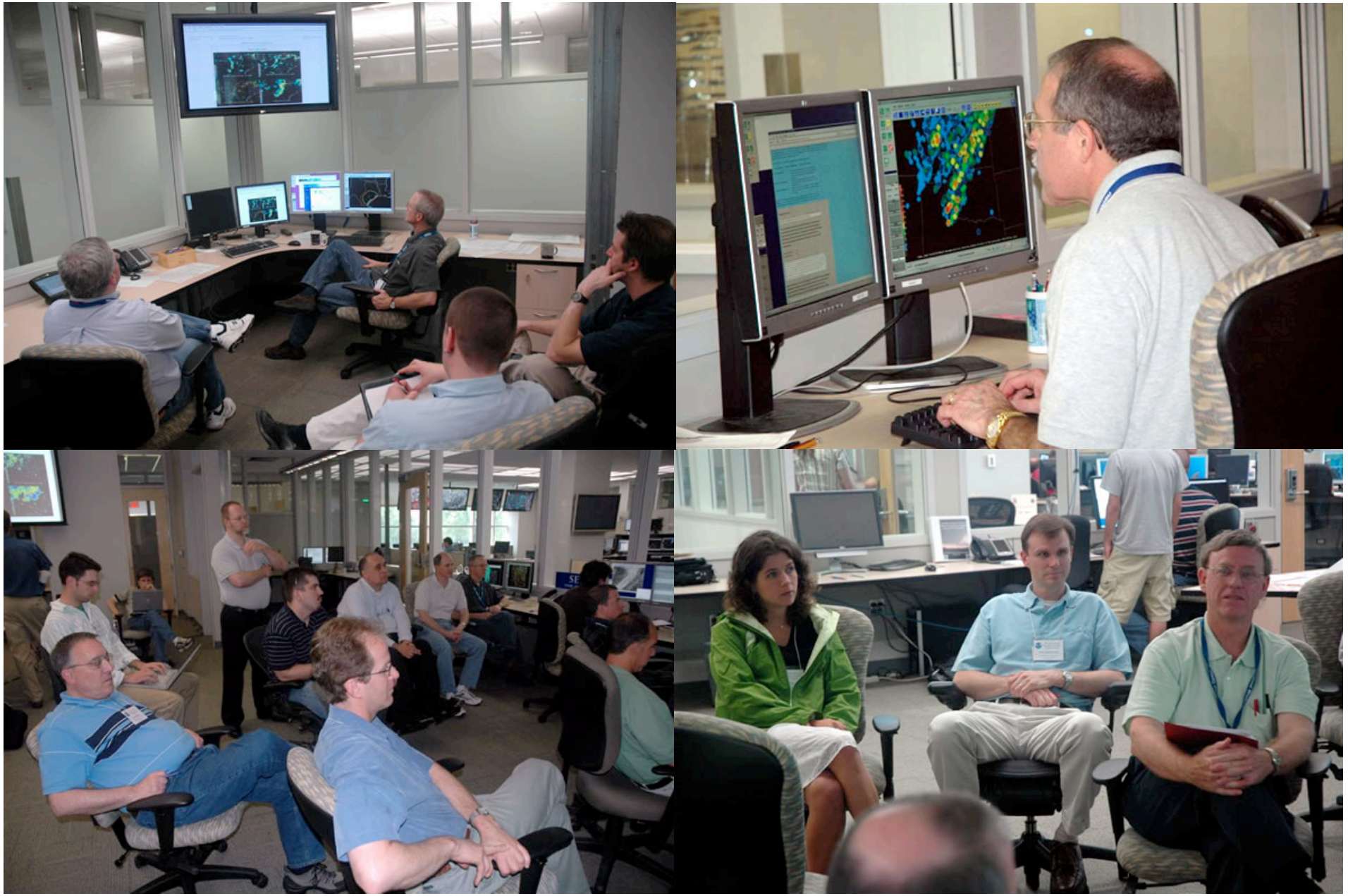
- Forecast tornadoes, thunderstorms, and wildfires nationwide
- Forecast information from 8 days to a few minutes in advance
- World class team engaged with the research community
- Partner with over 120+ local National Weather Service offices

GOES- R Proving Ground

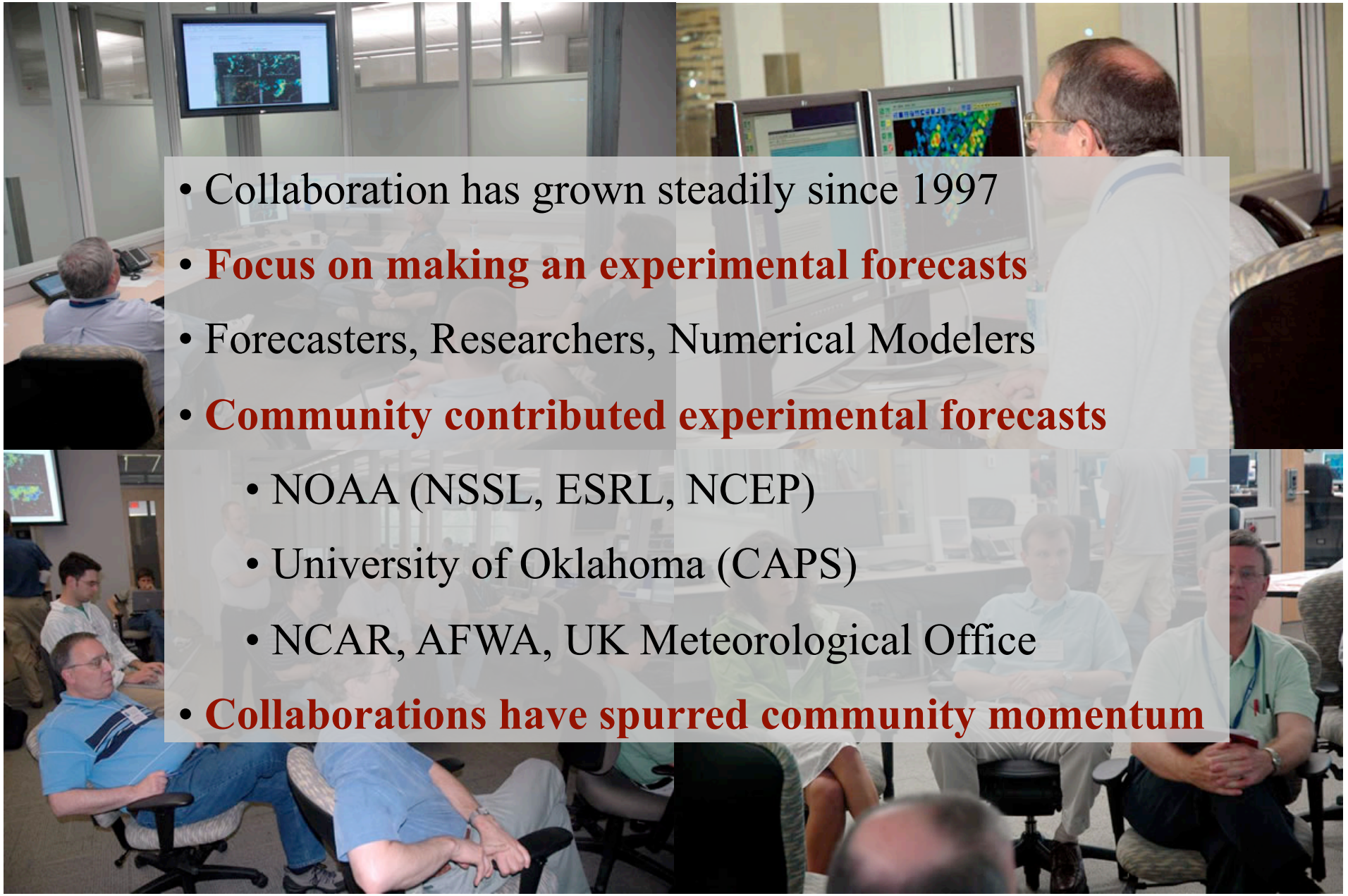


Hazardous Weather Testbed
Experimental Forecast Program

Forecast Focused Community Collaboration

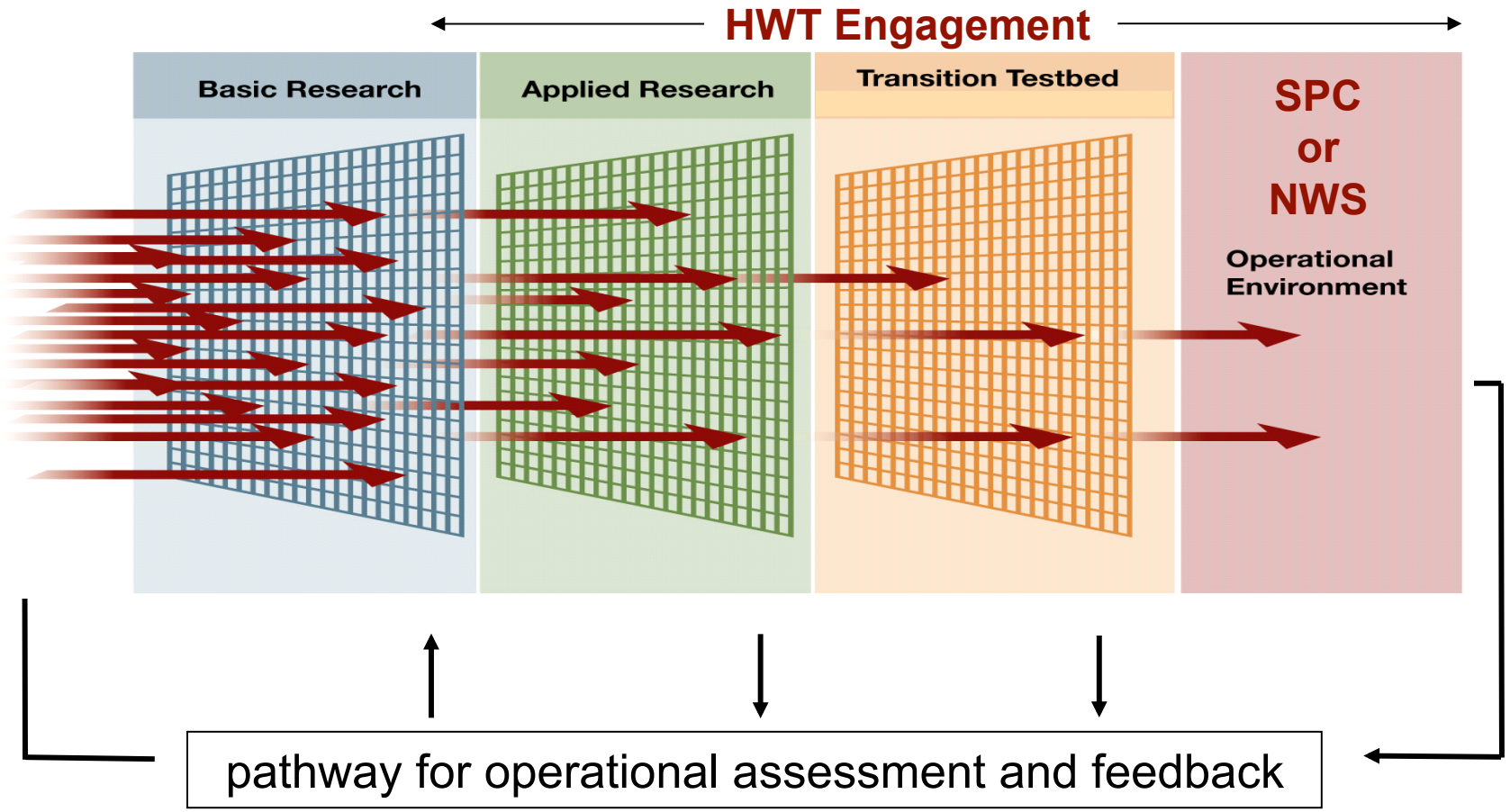


Forecast Focused Community Collaboration



- Collaboration has grown steadily since 1997
- **Focus on making an experimental forecasts**
- Forecasters, Researchers, Numerical Modelers
- **Community contributed experimental forecasts**
  - NOAA (NSSL, ESRL, NCEP)
  - University of Oklahoma (CAPS)
  - NCAR, AFWA, UK Meteorological Office
- **Collaborations have spurred community momentum**

R2O: Hazardous Weather Testbed



Engage the community with a focus on forecast improvement

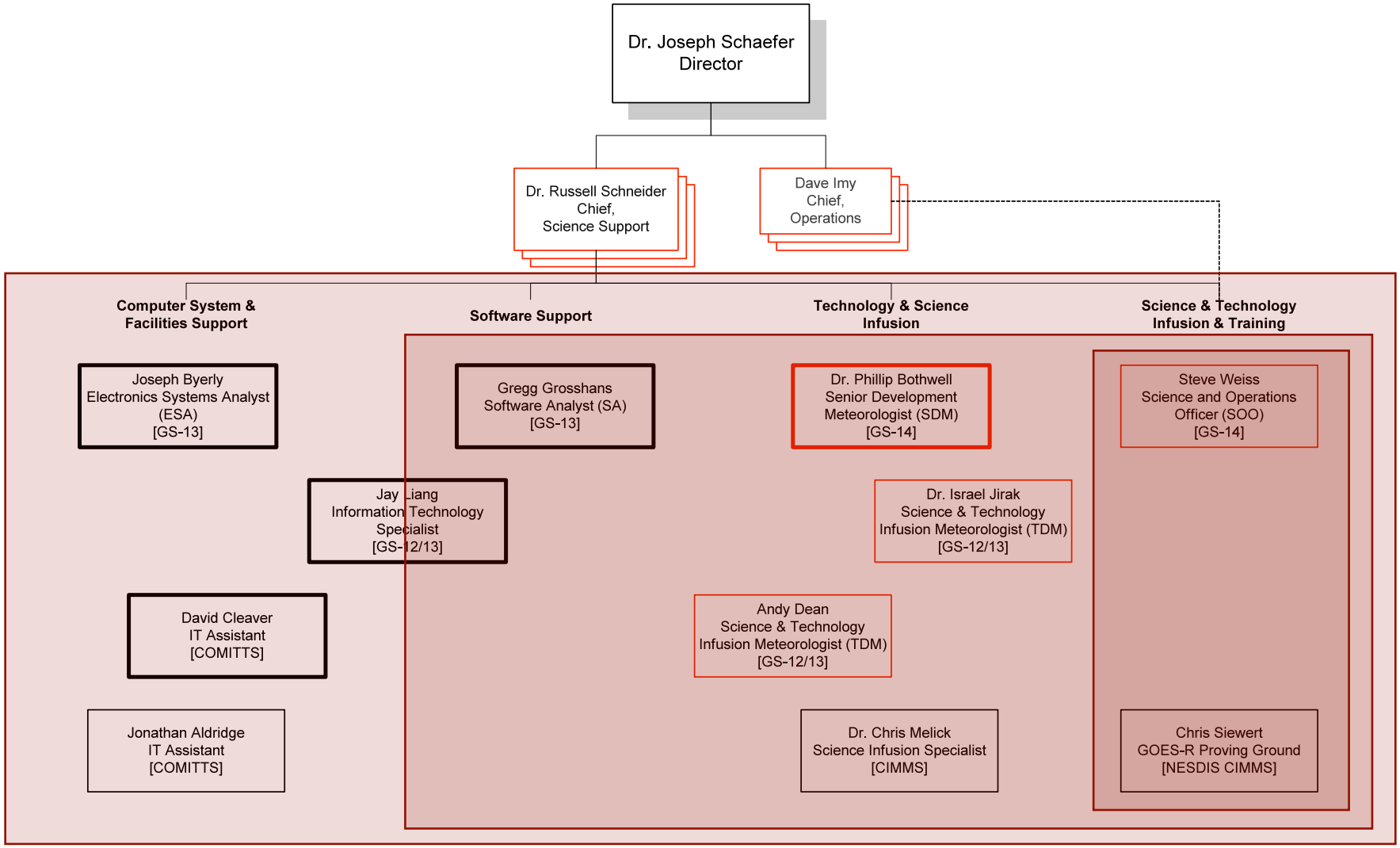
Core HWT-EFP Collaborators

- **NWS SPC & OAR NSSL – Core HWT-EFP Partners**
- **NCEP EMC – Environmental Modeling Center**
- **GSD – ESRL Global System Division**
- **GOES-R – NESDIS GOES-R Proving Ground**
- **DTC – Developmental Testbed Center**
- **OU CAPS – Center for Analysis and Prediction of Storms**
- **NCAR – National Center for Atmospheric Research**

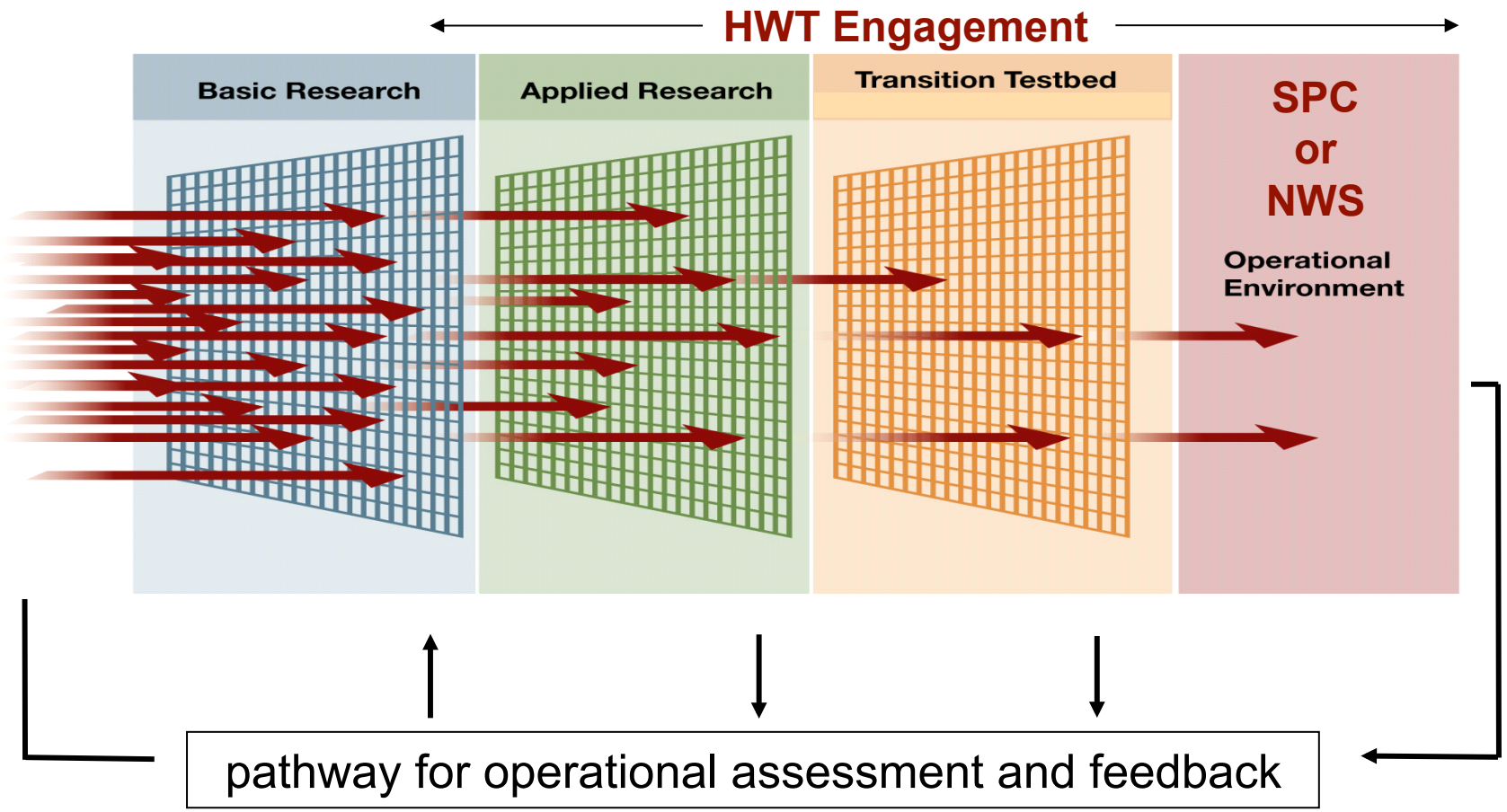
Who from the SPC contributes to the HWT-EFP?

Storm Prediction Center - Science Support Branch

November 2009

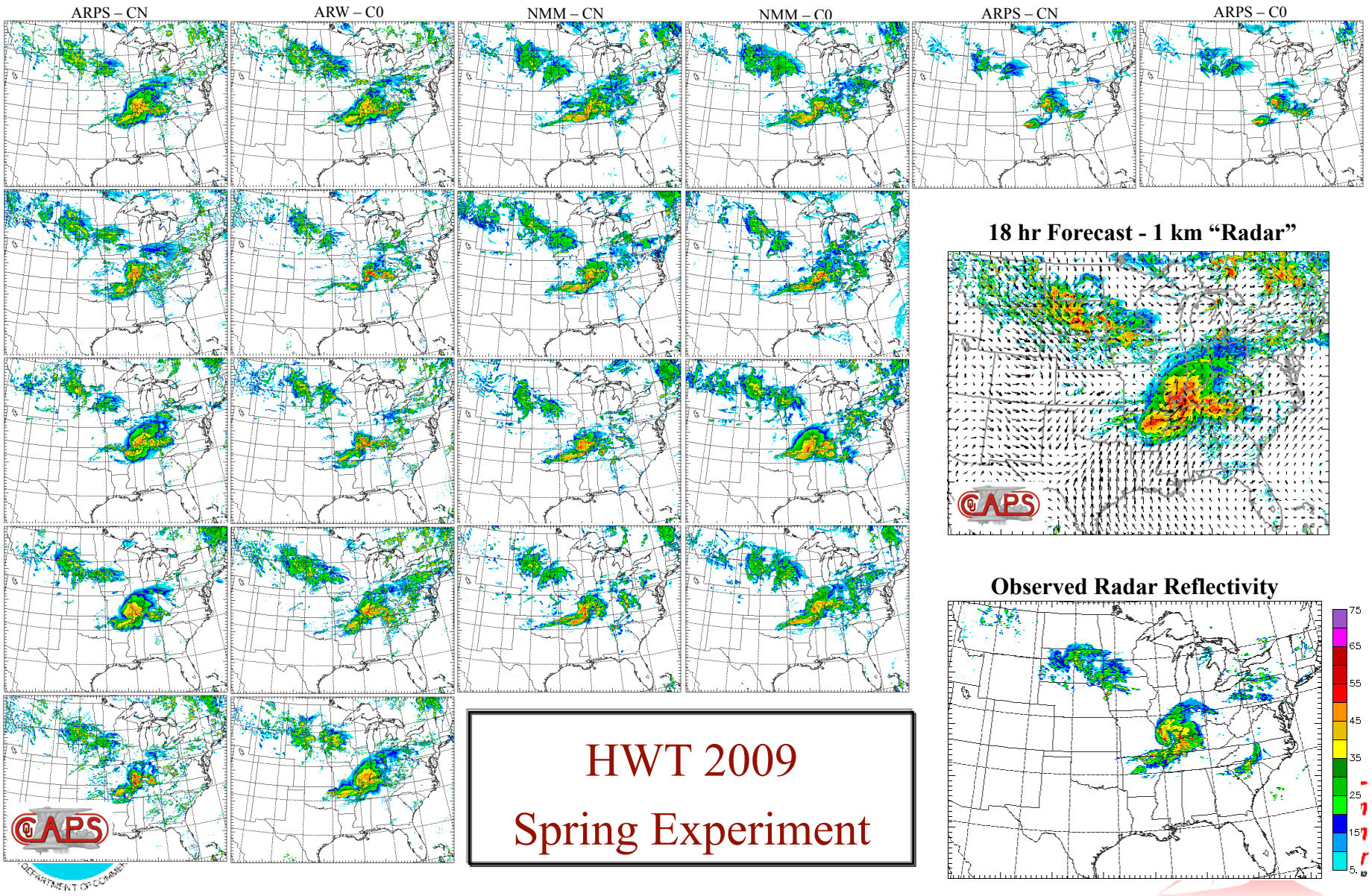


R2O: Hazardous Weather Testbed



Engage the community with a focus on forecast improvement

Ensembles: Explore & Define Uncertainty



HWT 2009
Spring Experiment

18 hr Forecast - 1 km "Radar"

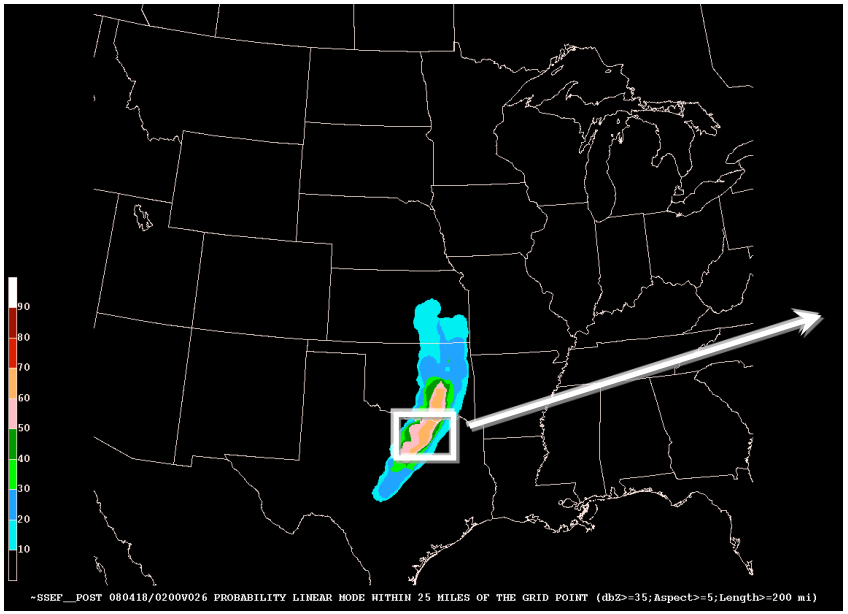
Observed Radar Reflectivity

FY10: Leverage SPC HWT & PG

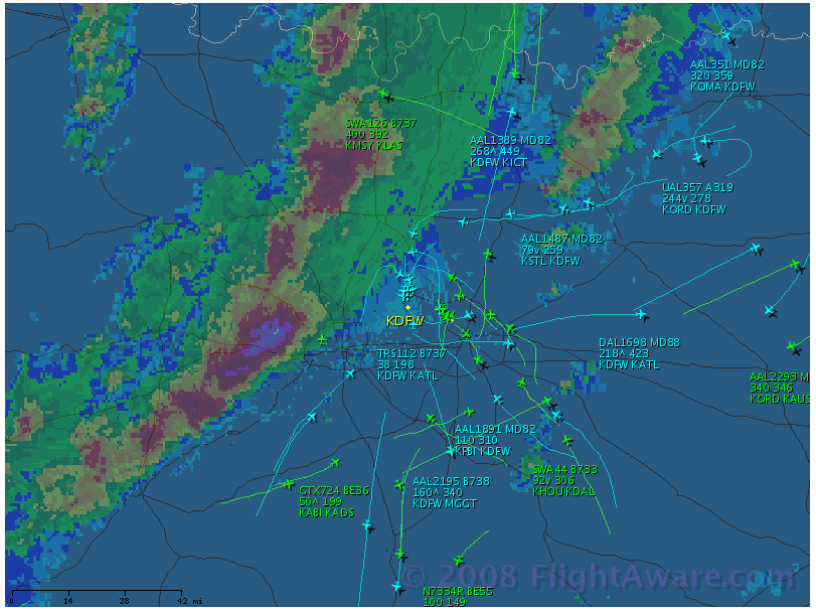
- **We will leverage existing community expertise** to reduce resource duplication and sustain core partnerships
- **SPC-AWC will lead a joint FY10 HWT experiment on convection and its impacts on aviation**
  - SPC, AWC, WFO, and CWSU forecaster collaboration to **build community** and **improve consistency** in NWS convective forecasts
  - **Participants from aviation enterprise** (FAA, NextGen, Mitre, MIT-LL)
  - Science focus on forecast tools for convection including high resolution ensembles with partners at OAR-GSD, OU-CAPS, and EMC
  - **SPC-AWC shared resources** to leverage HWT during AWT spin up
- **SPC-HPC Heavy Rainfall focus with HPC-HMT**

Aviation Impacts from Thunderstorms

Hazardous Weather Testbed Experimental Forecast



26 hour Forecast of a Squall Line at 7:00 pm 18 April 2008



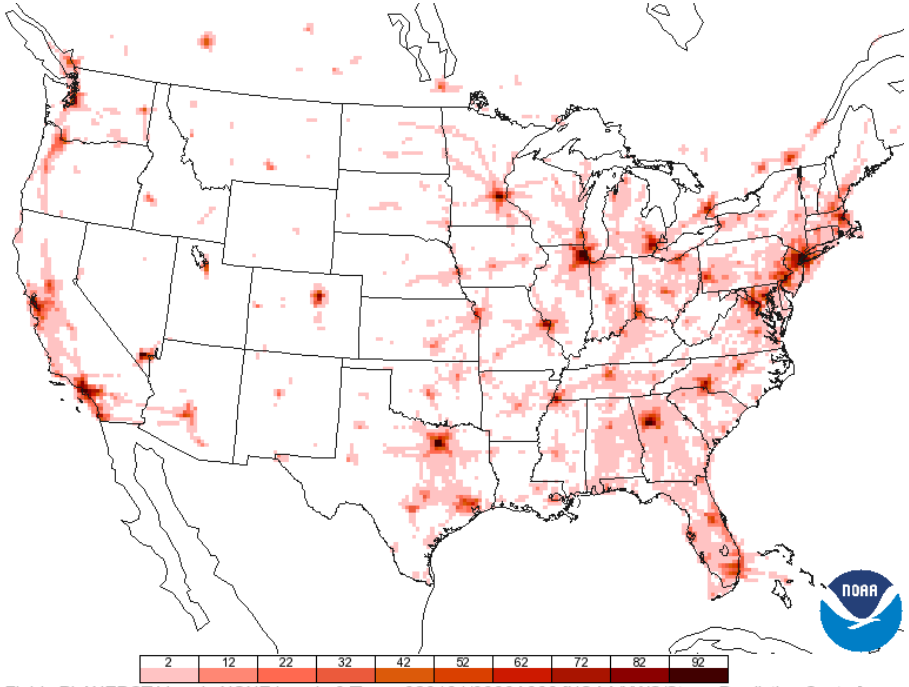
Observed Aviation impacts 7:00 pm 18 April 2008

- **Adverse weather costs approximately $30B / year**
- **Thunderstorms cause two-thirds of all delays**
- **Support improved airspace management**

Storm Prediction Center
Norman, Oklahoma

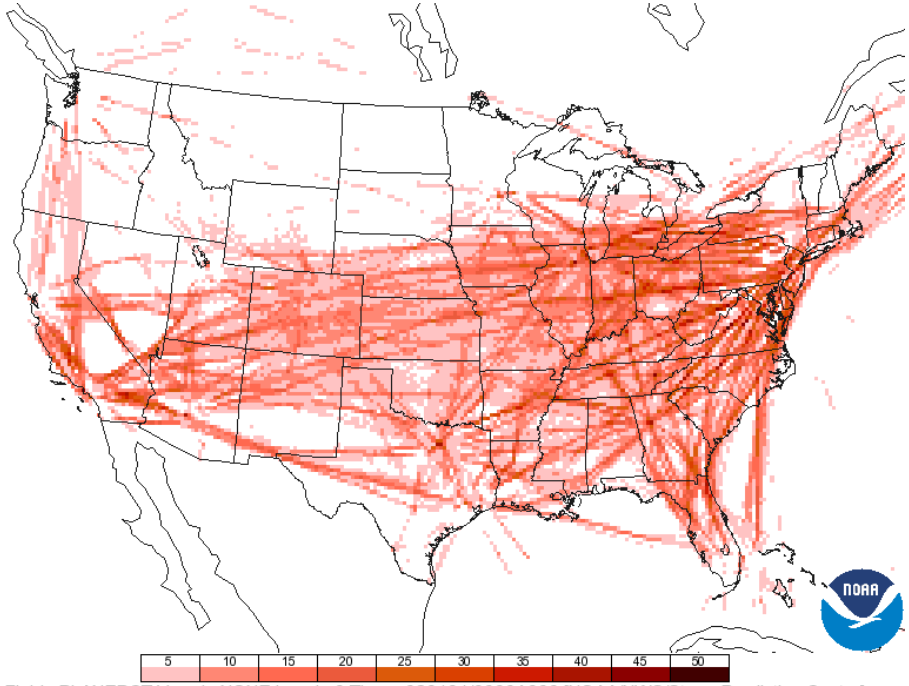
Exploit Storm Ensembles for Aviation Planning

All Flights ≤ 10,000 Feet



Field= PLANEPCT Vcord= NONE Level= 0 Time= 080101/0000A000 [NOAA/NWS/Storm Prediction Center]

All Flights ≥ 25,000 Feet

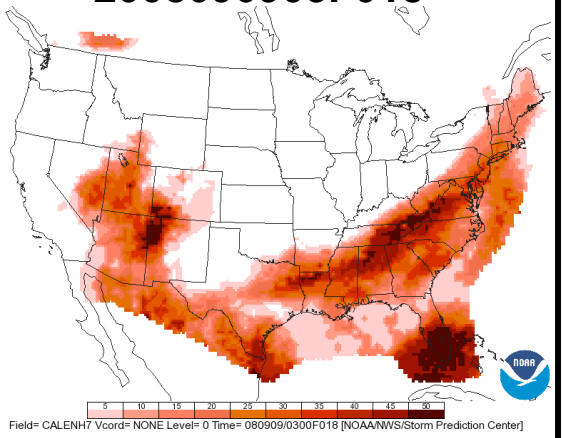
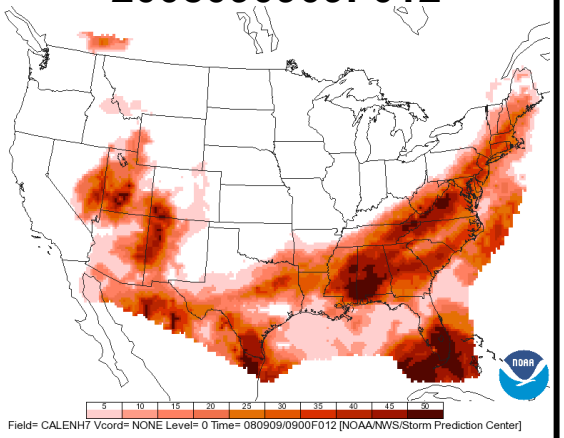
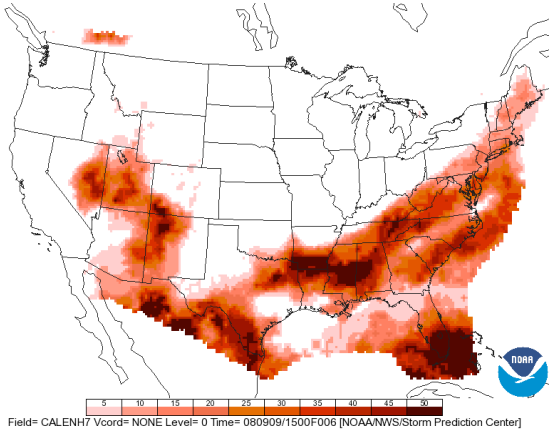
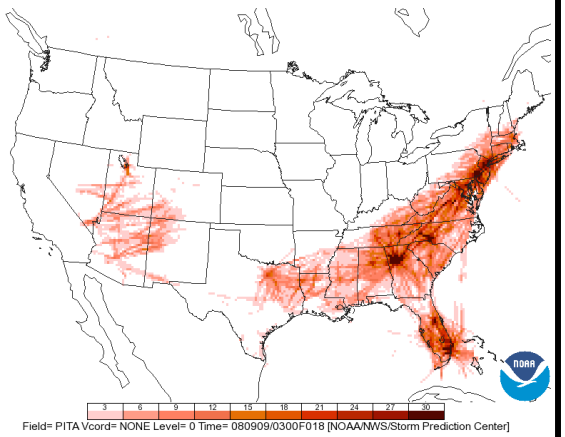
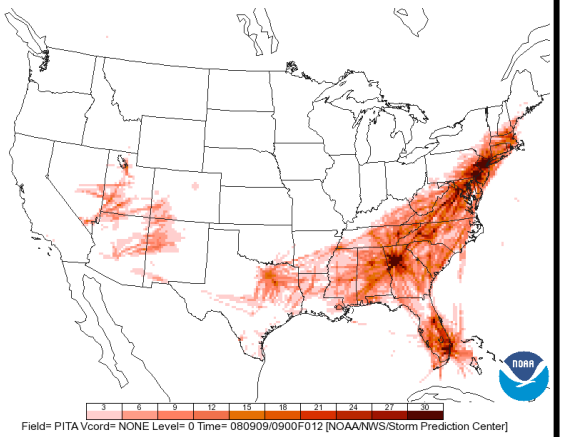
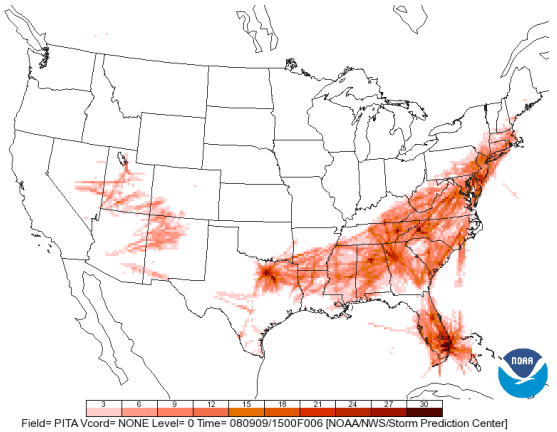
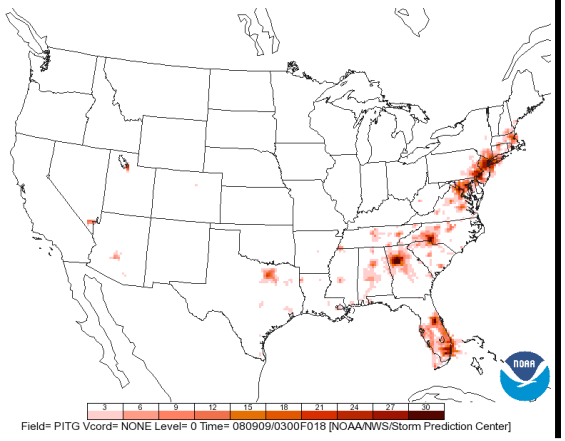
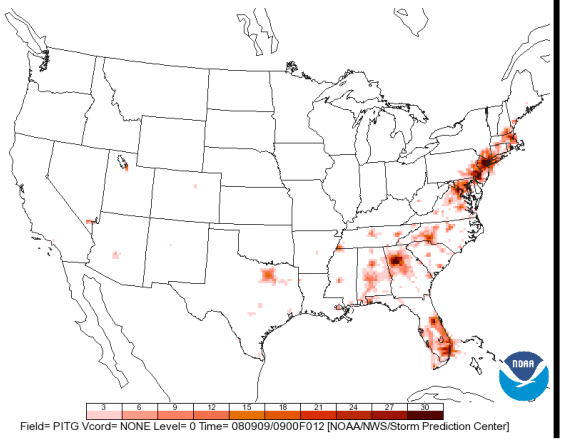
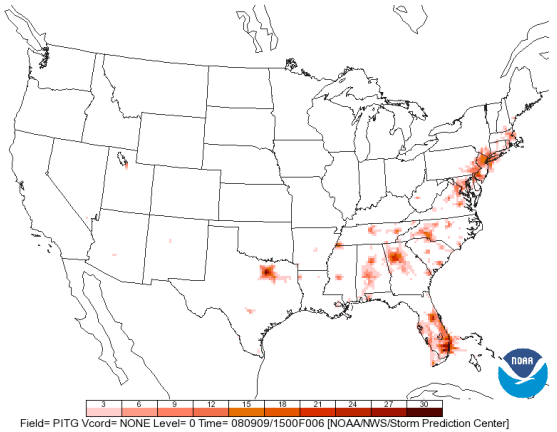


Field= PLANEPCT Vcord= NONE Level= 0 Time= 080101/0000A000 [NOAA/NWS/Storm Prediction Center]

Snapshot probability of an aircraft inside the 20 km (AWIPS 215) grid box

Storm Prediction Center
Norman, Oklahoma

SREF Valid time: 21 UTC Sept 09, 2008

	2008090903F018	2008090909F012	2008090915F006
Prob Tstm			
	Field= CALENH7 Vcord= NONE Level= 0 Time= 080909/0300F018 [NOAA/NWS/Storm Prediction Center]	Field= CALENH7 Vcord= NONE Level= 0 Time= 080909/0900F012 [NOAA/NWS/Storm Prediction Center]	Field= CALENH7 Vcord= NONE Level= 0 Time= 080909/1500F006 [NOAA/NWS/Storm Prediction Center]
Impact All Levels			
	Field= PITA Vcord= NONE Level= 0 Time= 080909/0300F018 [NOAA/NWS/Storm Prediction Center]	Field= PITA Vcord= NONE Level= 0 Time= 080909/0900F012 [NOAA/NWS/Storm Prediction Center]	Field= PITA Vcord= NONE Level= 0 Time= 080909/1500F006 [NOAA/NWS/Storm Prediction Center]
Impact Below 10kft			
	Field= PITG Vcord= NONE Level= 0 Time= 080909/0300F018 [NOAA/NWS/Storm Prediction Center]	Field= PITG Vcord= NONE Level= 0 Time= 080909/0900F012 [NOAA/NWS/Storm Prediction Center]	Field= PITG Vcord= NONE Level= 0 Time= 080909/1500F006 [NOAA/NWS/Storm Prediction Center]

HWT-EFP Future Directions

. . . to achieve potential societal benefits

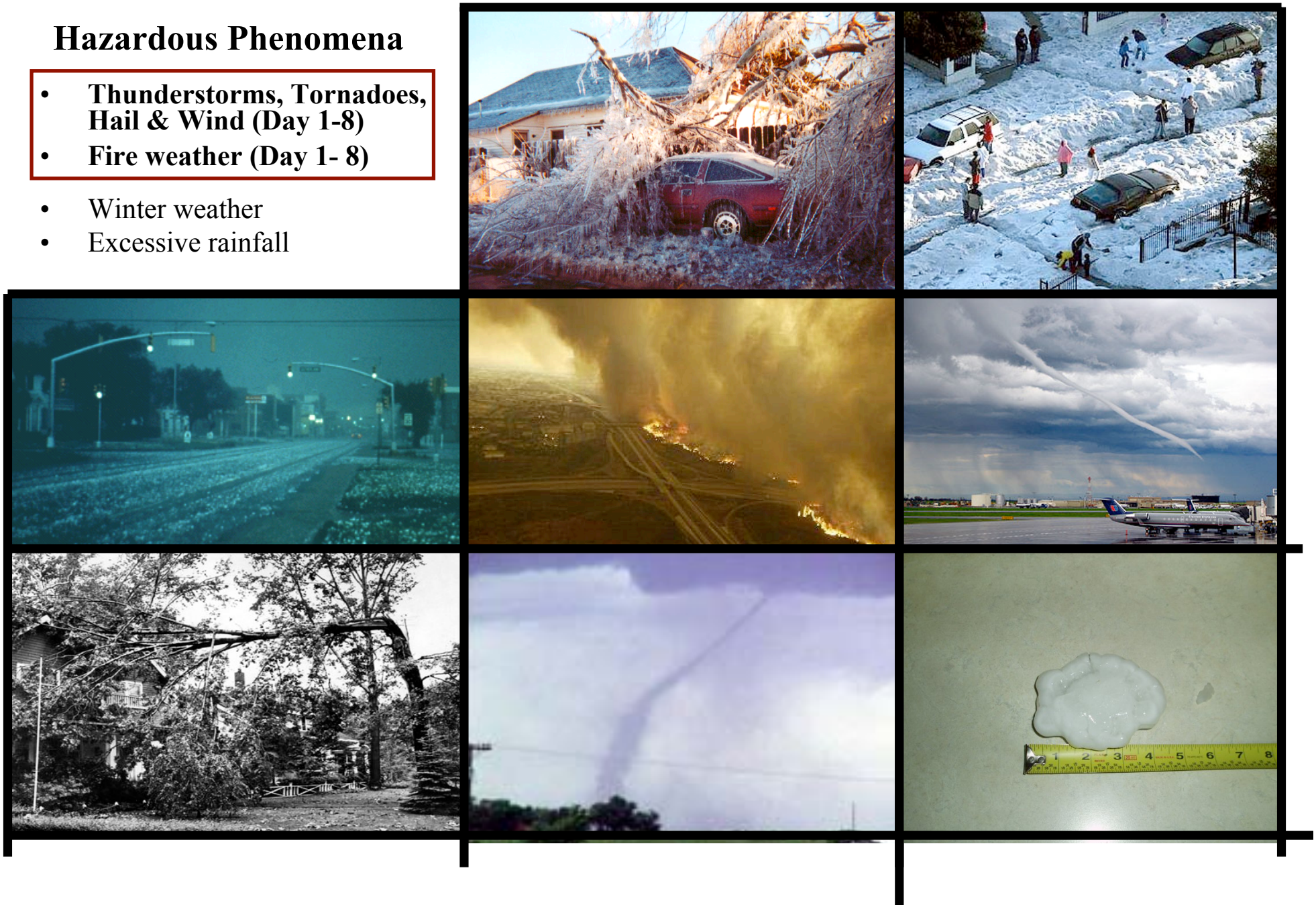
Storm Prediction Center
Norman, Oklahoma

Storm Prediction Center – Diverse Mission

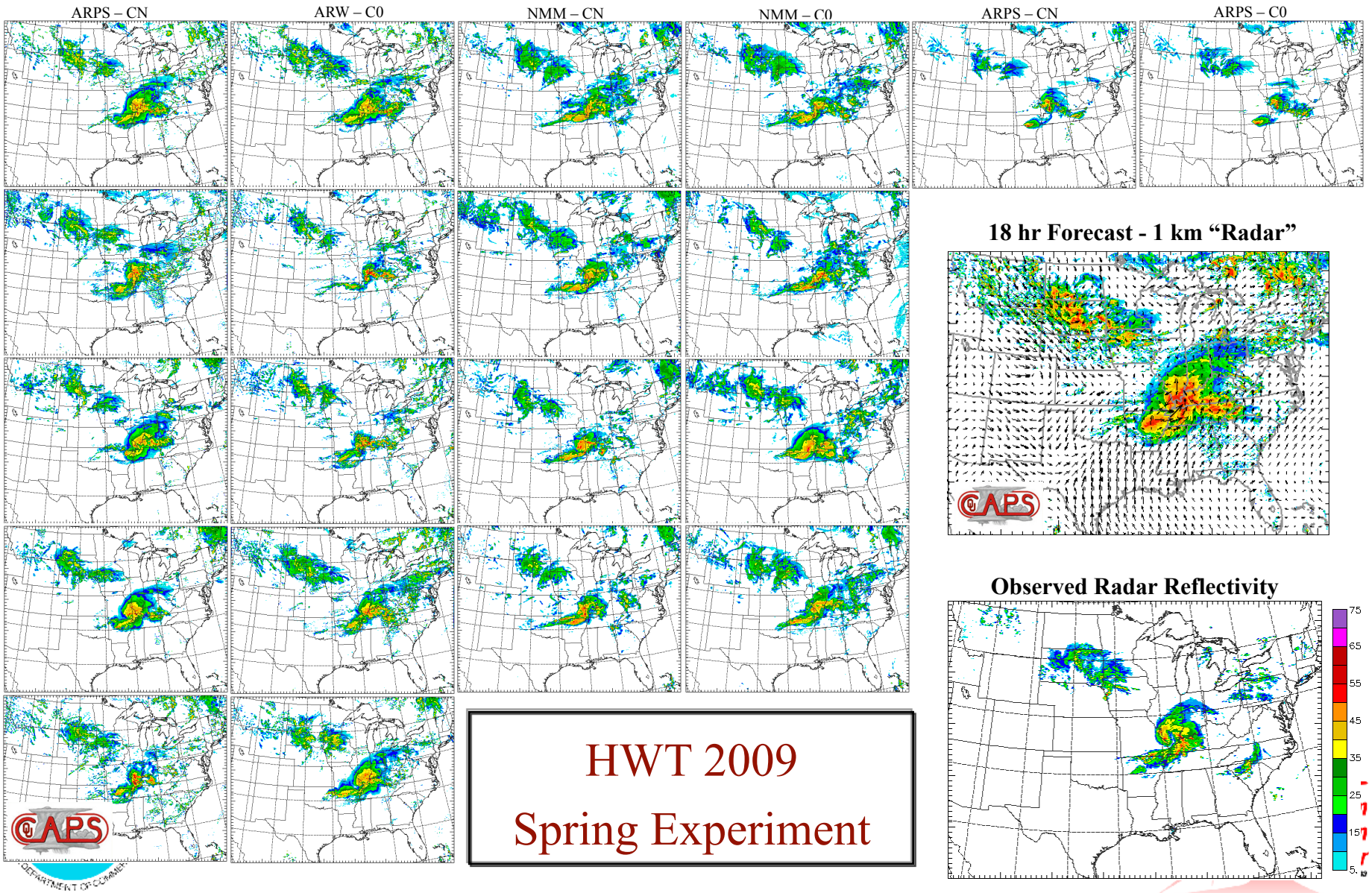
Hazardous Phenomena

- **Thunderstorms, Tornadoes, Hail & Wind (Day 1-8)**
- **Fire weather (Day 1- 8)**

- Winter weather
- Excessive rainfall



Ensembles: Next Generation with DTC



HWT 2009
Spring Experiment

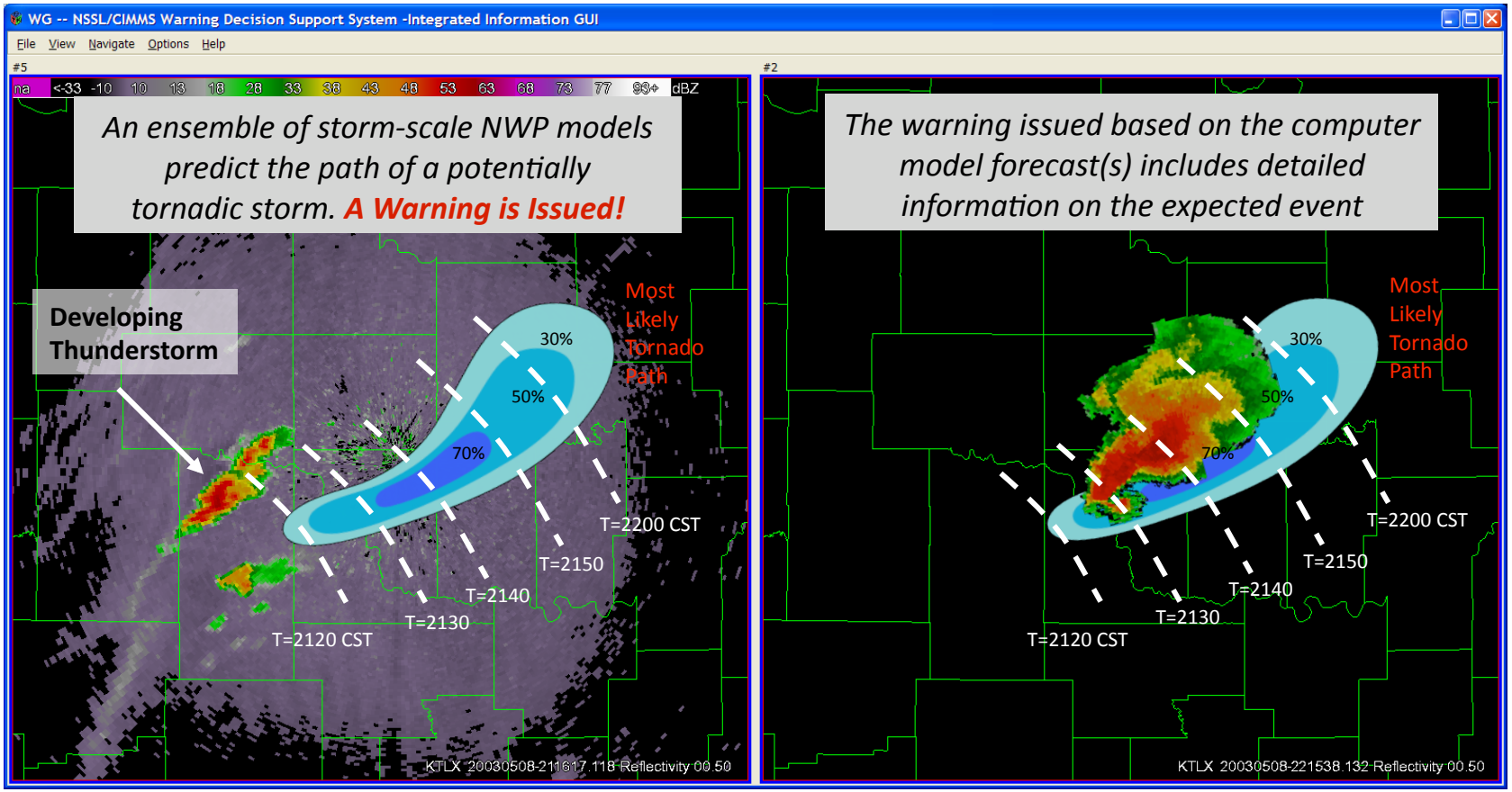
18 hr Forecast - 1 km "Radar"

Observed Radar Reflectivity

Vision: Warn-on-Forecast

Radar and Initial Forecast at 2100 CST

Radar at 2130 CST: Accurate Forecast

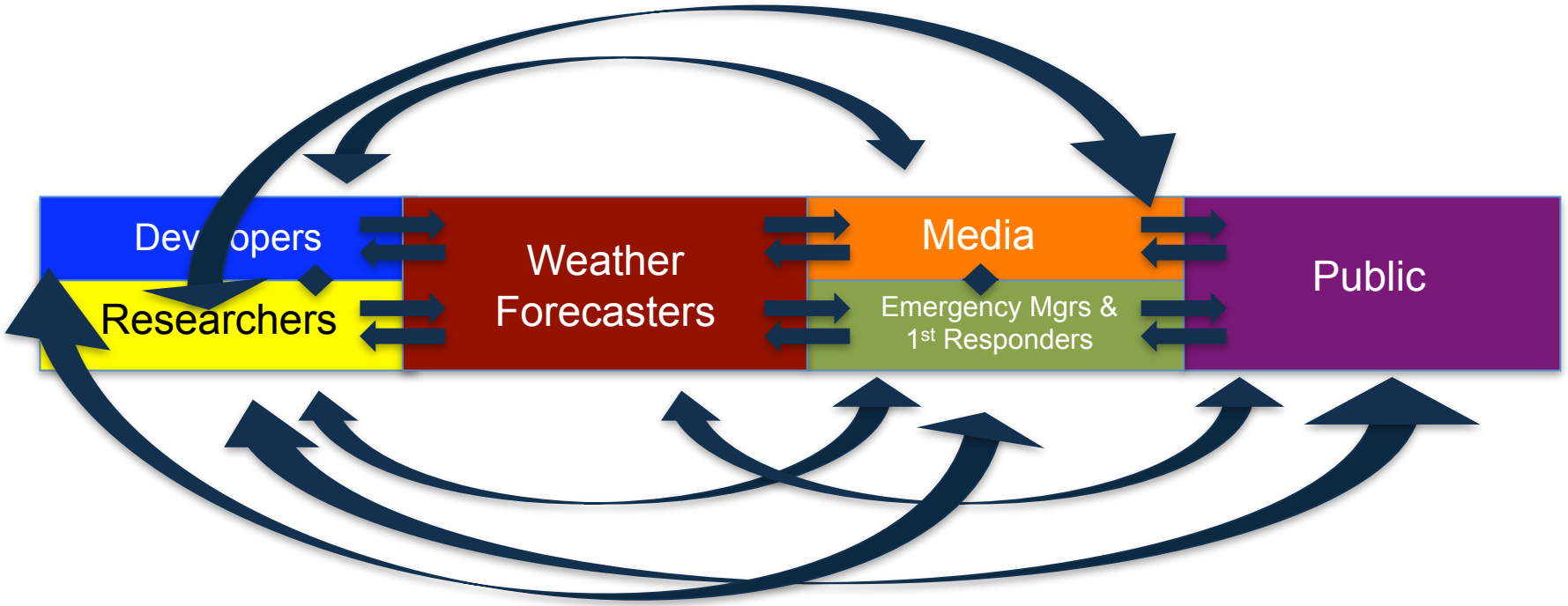


- Triple current Tornado Warning lead times
- Support enhanced community response

Service & Science Challenges

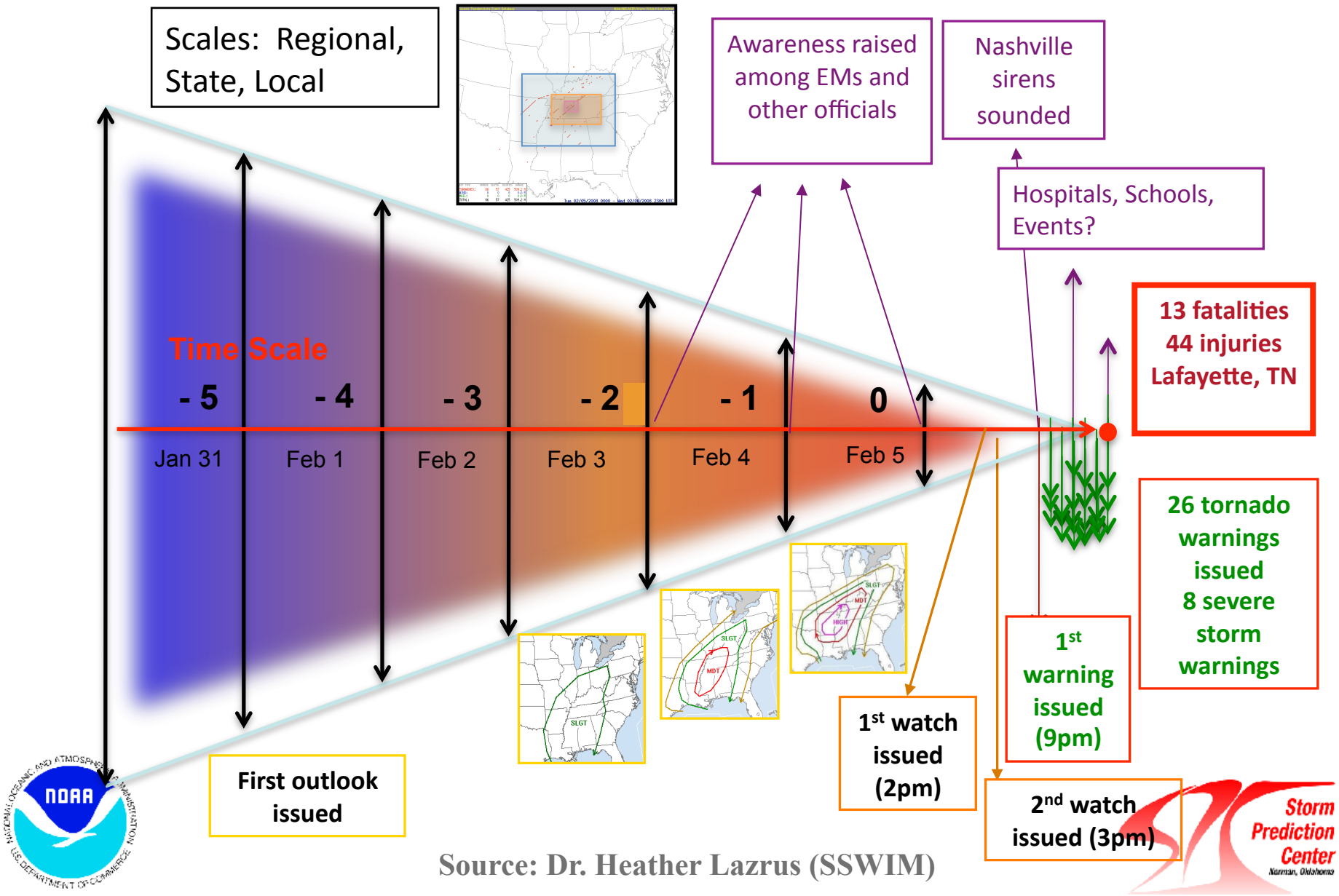
- **Major Science Challenges**
  - the **convective initiation** challenge
  - impacts of **mesoscale variability** on storm predictability
  - **appropriate NWP resolutions** for severe storm prediction
  - advanced **cloud microphysics & BL** for storm scale NWP
  - **radar (& other) data assimilation** for storm scale NWP
  - **extraction of storm information** from high resolution NWP
  - **perturbation strategies** for storm scale ensembles
  - extraction of **probabilistic information from storm scale ensembles**
- **Service & Societal Challenges**
  - Effective **communication** of risk, primary threat & uncertainty
  - Create a **continuous information stream** for decision support

Completing the Forecast:
Improving Effectiveness of NWS Services



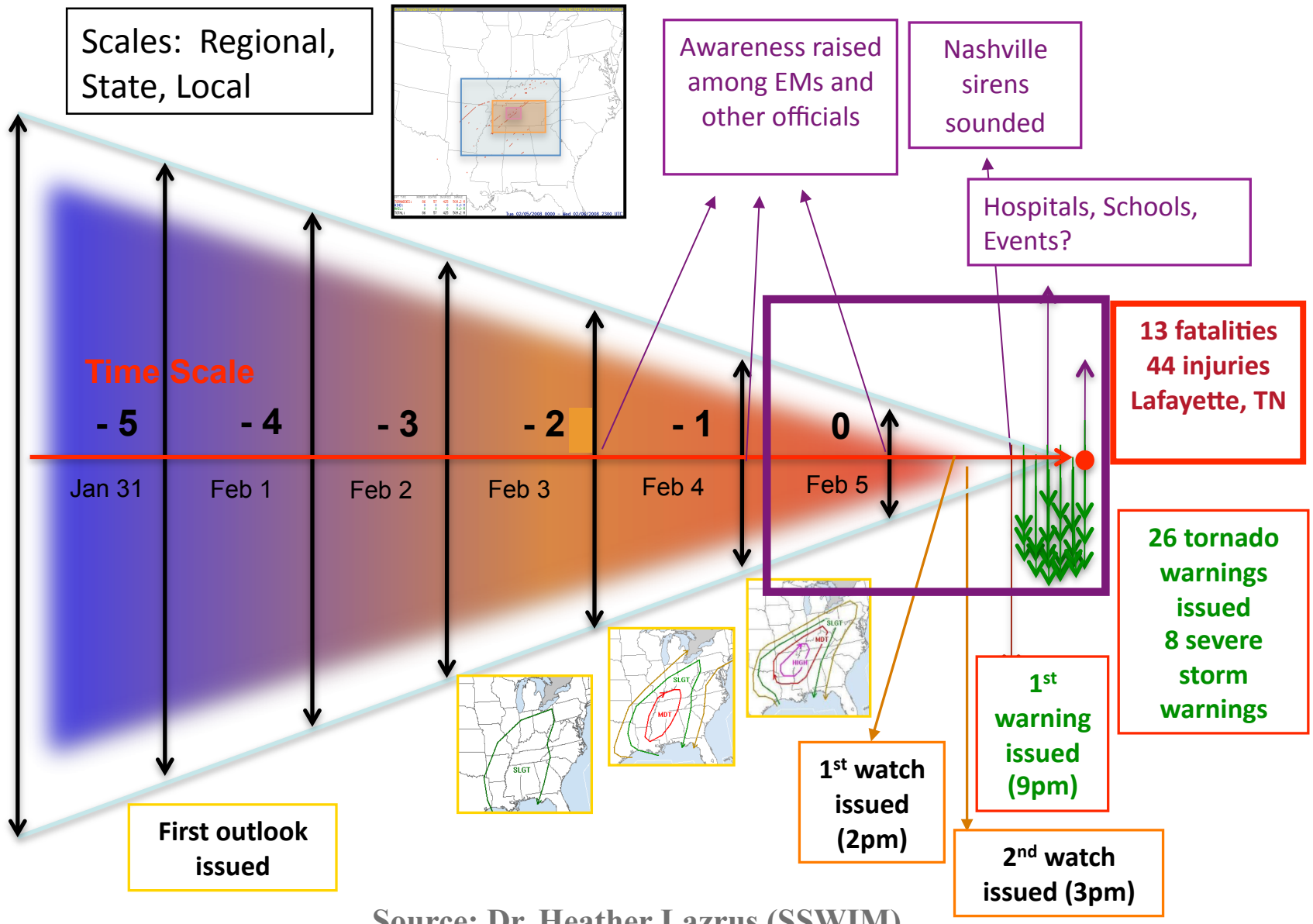
Source: Dr. Heather Lazrus (SSWIM)

A Continuous Stream of Weather Decision Support Information



Source: Dr. Heather Lazrus (SSWIM)

A Continuous Stream of Weather Decision Support Information



Source: Dr. Heather Lazrus (SSWIM)

www.spc.noaa.gov

Russell.Schneider@noaa.gov